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EXAMINER	
RASHID, DAVID	
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SHORTENED STATUTORY PERIOD OF RESPONSE	NOTIFICATION DATE	DELIVERY MODE
3 MONTHS	04/11/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Notice of this Office communication was sent electronically on the above-indicated "Notification Date" and has a shortened statutory period for reply of 3 MONTHS from 04/11/2007.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/806,180	Applicant(s) ITOH ET AL.
	Examiner David P. Rashid	Art Unit 2609

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,8-12 and 15-20* is/are rejected.

7)☒ Claim(s) *5-7,13 and 14* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 March 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :7/28/2004, 8/25/2004, 3/23/2005, 8/29/2006.

DETAILED ACTION

All of the examiner's suggestions presented herein below have been assumed for examination purposes, unless otherwise noted.

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

2. The drawings are objected to because of the following:

(i) FIG. 1, reference numerals 11 and 12 do not properly extend to the first and second blocks in question, and they do not correctly align as disclosed in the specification – suggest extending reference numeral 11 to the next proceeding box to the right and extending reference numeral 12 to the next proceeding box below.

(ii) FIG. 2, reference numerals S104, S105, and S106 do not properly disclose the information in the specification from page 10, line 25 through page 11, line 12. All changes must also reflect unto FIG. 10.

(iii) FIG. 2, reference numeral S108 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Extract 3rd block of the same size and shape as 2nd block from m-th frame" or change the specification. All changes must also reflect unto FIG. 10.

(iv) FIG. 2, reference numeral S109 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Extract 4th block of the same size and shape as 3rd block from (m+n)-th frame" or change the specification. All changes must also reflect unto FIG. 10.

(v) FIG. 2, reference numeral S110 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "...opposite pixels of 3rd and 4th blocks every pixel" or change the specification. All changes must also reflect unto FIG. 10.

(vi) FIG. 3, reference numeral S114 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Extract 5th block from 4th block" or change the specification. All changes must also reflect unto FIG. 10.

(vii) FIG. 3, reference numeral S115 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Extract 6th block from 4th block" or change the specification.

(viii) FIG. 3, reference numeral S117 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Copy 1st, 5th, and 6th blocks..." or change the specification.

(ix) FIG. 4, reference numerals 11 does not properly extend to the block in question, suggest extending reference numeral 11 to the next proceeding box below.

(x) FIG. 7, reference numerals 21 and 22 must be switched because they do not properly disclose the information provided by the specification.

(xi) FIG. 11, reference numeral S117 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Copy 1st and 5th blocks…" or change the specification.

(xii) FIG. 13A contains incorrect reference numerals – suggest changing "MV3" to "MV13" and "MV4" to "MV14".

(xiii) FIG. 13A reference numerals 21 and 22 must be switched because they do not properly disclose the information provided by the specification.

(xiv) FIG. 13B contains an incorrect reference numeral – suggest changing "16" to "52" or change the specification.

(xv) FIG. 15, reference numeral S212 makes reference to an incorrect block as disclosed in the specification – suggest changing to "Extract 3rd block…" or change the specification.

(xvi) FIG. 15, reference numeral S213 makes reference to an incorrect block as disclosed in the specification – suggest changing to "…from the third block" or change the specification.

(xvii) FIG. 15, reference numeral S215 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Extract 4th block….according to 2nd motion vector" or change the specification.

(xviii) FIG. 15, reference numeral S216 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "…pixels of 3rd and 4th block…" or change the specification.

(xix) FIG. 16, reference numeral S217 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Do pixels of 4th block…" or change the specification.

(xx) FIG. 16, reference numeral S220 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Extract 5th block from at least 4th block" or change the specification.

(xxi) FIG. 16, reference numeral S221 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Extract 6th block from at least 4th block" or change the specification.

(xxii) FIG. 16, reference numeral S222 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "…in 5th and 6th to-be-interpolated blocks)" or change the specification.

(xxiii) FIG. 16, reference numeral S223 makes reference to the incorrect blocks as disclosed in the specification – suggest changing to "Copy 1st, 5th, and 6th blocks…" or change the specification.

(xxiv) FIG. 17 contains incorrect reference numerals – suggest adding the value "1" to all reference numerals (e.g. "100" changed to "101").

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure

must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

3. FIG. 1, FIG. 6, , FIG. 8B, FIG. 12A, and FIG. 20 are objected to under 37 CFR 1.83(a) because they fail to show the subject matter as described in the specification.

(i) Page 15, line 23 states "This first motion vector MV1 is a motion vector from a sub block corresponding to the first sub block 14 of the first block 11 to the..." wherein FIG. 1 and FIG. 6 does not contain where the first sub block is, nor where it is pointing to.

(ii) Page 13, line 9 states "...the third sub block 15 (the region surrounded with a dotted line)..." where in face reference numeral 15 of FIG. 8B does not contain a dotted line region.

(iii) Page 19, line 27 states "Subsequently, the first block 11 of the same size and shape as the to-be-interpolated block 51 is extracted from the m-th frame 1..."; however, the first block 11 is not of the same size and shape as the to-be-interpolated block 51 in FIG. 12A.

(iv) The specification makes multiple reference to "(m+n)-th frame 2" when disclosing FIG. 20, yet the drawings do not depict reference numeral "2" – suggest adding arrow reference numeral 2 to middle frame in FIG. 20.

Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description:

"2001", "2002", "2003", "2163", and "2163".

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

5. The disclosure is objected to because of the following informalities:

(i) Page 9, line 25 makes reference to the wrong reference numeral – suggest changing to "...(step S100).".

(ii) Page 10, lines 26 - 27 makes reference to the wrong reference numeral – suggest changing to "...the first sub block 14 including...".

(iii) Page 11, line 2 makes reference to the wrong reference numeral – suggest changing to "...the second sub block 13 including...".

(iv) Page 12, line 2 contains a grammatical error – suggest changing to "When there is an object...".

(v) Page 12, line 15 contains a typo – suggest changing to "...as shown in FIG. 7.".

(vi) Page 14, line 1 contains a grammatical error – suggest changing to "...pixels that belong to...".

(vii) Page 14, line 21 contains a grammatical error – suggest changing to "The weighting factor used in…".

(viii) Page 15, line 26 is unclear as to where the first motion vector MV1 is pointing to when stating "This first motion vector MV1 is a motion vector from a sub block corresponding to the first sub block 14 of the first block 11 to the first sub block 14." as it is neither supported in the drawings.

(ix) Page 17, line 20 contains a grammatical error – suggest changing to "….is made smaller than the 1^{st}…".

(x) Page 19, line 27 contains a typo – suggest changing "…(step S2 Subsequently,…" to "…(Step S200). Subsequently,…".

(xi) Page 21, line 21 contains a grammatical error – suggest changing to "…are divided into the first region…".

(xii) Page 22, line 12 contains a typo – suggest changing "…(step S2 14)." to "…(step S214).".

(xiii) Page 23, line 21 makes reference to the wrong reference numeral – suggest changing to "…step S219 is compared…".

(xiv) Page 24, line 19 contains a typo – suggest changing to "..,.steps S200 to S223 is done…".

(xv) Page 25, lines 17 – 19 is unclear as to what is being disclosed completely – suggest complete revision.

(xvi) Page 29, line 10 makes reference to the wrong reference numeral – suggest changing to "…sub block 2023 according…".

(xvii) Page 30, line 6 contains a grammatical error – suggest changing to "In this case, a search for a ....".

(xviii) Page 31, line 10 contains a grammatical error – suggest changing to "...the threshold for every pixel...".

(xix) Page 32, line 11 makes reference to the wrong reference numeral – suggest changing to "...fourth sub block 2124...".

(xx) Page 32, line 13 makes reference to the wrong reference numeral – suggest changing to "...block 2130...".

(xxi) Page 33, line 9 contains a grammatical error – suggest changing to "...computed for every...".

Appropriate correction is required.

Claim Objections

6. 37 CFR 1.75(a) reads as follows:

> The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

7. Claims 1 through 9 are objected to because of the following informalities:

(i) Claim 1, line 21 - 22 states "..., the region corresponding to a region that the absolute difference value is not less than the threshold;..." where in fact the objective of the third sub block is to have a "strong correlation" with respect to the second sub block as supported in the specification. If the third sub block is to have a strong correlation with respect to the second sub block, then the absolute difference value between the sub

blocks would have to be less than the threshold (as supported in the extraction step of this claim) – suggest changing to "...difference value is less than the threshold.".

(ii) Claim 4, line 2 contains a grammatical error – suggest changing to "....fires absolute difference...".

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. **Claims 1, 2, 3, 4, 9, 15, 16, 17, 18, 19** and **20** are rejected under 35 U.S.C. 102(b) as being anticipated by Chan et al. (Experiments on block-matching techniques for video coding, Multimedia Systems, Springer-Verlag,1994, 2:228-241).

Regarding **claim 1**, Chan discloses a method of generating an interpolation image comprising ("In this paper, we present results for various block-matching techniques and propose a low-complexity block-matching motion-estimation algorithm that is useful for hybrid video coding schemes, including MPEG video.", page 228, left column, first paragraph.):

dividing a first image into a plurality of first blocks ("In the MPEG video standard, the video frames are first divided into nonoverlapping 16 x 16 blocks called macroblocks.", page 228, right column, second paragraph wherein the macroblocks are the "first blocks".);
searching a second image for a second block having a strong correlation with respect to one of the first blocks every first block ("Each macroblock is divided into blocks of 8 x 8 pixels and the DCT is then applied to the four blocks independently (i.e., an *intra codedmacroblock)* or to the residual signal of the macroblock predicted with motion estimation (i.e., *a non-intra-coded macroblock).*", page 228, right column, second paragraph where the divided blocks of the macroblocks undergo a block-matching algorithm: "We recall from Sect. 1 that, in the FSA, we search all possible (2p+ 1) candidate blocks to obtain the best matched block using a criterion such as MSE, MAE, or PDC.", page 230, left column, third paragraph. The second block is a macroblock of the preceding frame (second image). In essence, because the macroblocks are divided into blocks that then undergo block-matching, the macroblocks themselves are still being searched for a strong correlation between frames.);

deriving a first motion vector between the first block and the second block ("The best matched block is used as a prediction estimate for the block. The relative displacement between the block and the best matched block constitutes the motion vector that is transmitted to the receiver.In bidirectional motion estimation, a previous reference frame as well as a future reference frame are used in determining the motion vector for each block. The motion vector corresponding to the previous or future reference frame that results in the smallest matching error is transmitted to the receiver.", page 229, left column, first paragraph.);

extracting a first sub block and a second sub block from the first block, the first sub block including pixels that an absolute difference value is less than a threshold, the second sub block including pixels that the absolute difference value is not less than the threshold, the absolute difference value being an absolute difference value between opposite pixels of the first block and the second block ("Each macroblock is divided into blocks of 8 x 8 pixels and the DCT is then applied to the four blocks independently (i.e., an *intra codedmacroblock)* or to the residual signal of the macroblock predicted with motion estimation (i.e., *a non-intra-coded macroblock).*", page 228, right column, second paragraph where the divided blocks of the macroblocks undergo a block-matching algorithm: "We recall from Sect. 1 that, in the FSA, we search all possible (2p+ 1) candidate blocks to obtain the best matched block using a criterion such as MSE, MAE, or PDC.", page 230, left column, third paragraph. The second block is a macroblock of the preceding frame (second image). The first sub block and second sub block are any two blocks from the 16 x 16 block macroblock that has been divided to undergo block-matching. Unless the two blocks are exactly equal, it is inherent that there exists a threshold such that one of two chosen blocks (first sub block) will have an absolute difference value less than the threshold, and the other of the two chosen blocks (second sub block) will have an absolute difference value greater than the threshold, wherein the absolute difference value being an absolute difference value between opposite pixels of the first block and the second block.);

searching for a third sub block in a region on the second image, the third sub block having a strong correlation with respect to the second sub block, the region corresponding to a region that the absolute difference value is not less than the threshold ("We recall from Sect. 1 that, in the FSA, we search all possible (2p+ 1) candidate blocks to obtain the best matched block

using a criterion such as MSE, MAE, or PDC.", page 230, left column, third paragraph. More specifically, all blocks (including the second sub block of the current frame) undergo the PDC block-matching algorithm as cited: "Gharavi and Mills (1990) have proposed a simple matching criterion, namely, the PDC to reduce the computational complexity of the MSE and the MAE.", page 230, right column, third paragraph.);

deriving a second motion vector between the second sub block and the third sub block ("The best matched block is used as a prediction estimate for the block. The relative displacement between the block and the best matched block constitutes the motion vector that is transmitted to the receiver. In bidirectional motion estimation, a previous reference frame as well as a future reference frame are used in determining the motion vector for each block. The motion vector corresponding to the previous or future reference frame that results in the smallest matching error is transmitted to the receiver.", page 229, left column, first paragraph.); and

copying the first sub block and the second sub block onto a third image between the first image and the second image, using the first motion vector and the second motion vector ("A block diagram of the MPEG video coder is shown in Fig. 1. We note that this is essentially an interframe hybrid technique (Netravali 1988) which employs motion compensated prediction and interpolation followed by DCT coding. Here, the video sequence is organized into a set of Group of Pictures (GOP). Often, each GOP is a combination of one Intraframe (I), one or two forward predicted (P) frames and the rest bidirectionally interpolated (B) frames as shown in Fig. 2. The B frames are used to achieve higher data compression and are motion-compensation interpolated at the receiver from previously received I and P frames. Hence, I and P frames serve as reference frames for motion-compensated predictions. Only the intraframe correlation is exploited in the I

frames, whereas both the interframe and intraframe correlations are exploited in both the P and B frames.", page 229, right column, first paragraph).

Regarding **claim 2**, Chan discloses the method according to claim 1, wherein searching for the second block includes computing the absolute difference value between opposite pixels of each of a plurality of block candidates of the second image and the first block every pixel, counting pixels that the absolute difference value is less than the threshold to obtain the number of pixels, and selecting as the second block one of the block candidates in a search range that the number of pixels is maximum ("Gharavi and Mills (1990) have proposed a simple matching criterion, namely, the PDC to reduce the computational complexity of the MSE and the MAE.", page 230, right column, third paragraph. The PDC (pixel difference classification) method is disclosed from them on until the next page 231.).

Regarding **claim 3**, Chan discloses the method according to claim 1, wherein searching for the third sub block includes computing second absolute difference value between opposite pixels of the second sub block and each of a plurality of sub block candidates of the second image, counting pixels in the region that the second absolute difference value is less than second threshold to obtain the number of pixels, and selecting as the third sub block one of the sub block candidates in a search range that the number of pixels is maximum ("Gharavi and Mills (1990) have proposed a simple matching criterion, namely, the PDC to reduce the computational complexity of the MSE and the MAE.", page 230, right column, third paragraph. The PDC (pixel difference classification) method is disclosed from them on until the next page 231.).

Regarding **claim 4**, Chan discloses the method according to claim 2, wherein the absolute difference value is a first absolute different value and the threshold is a first threshold, and searching for the third sub block includes:

computing a second absolute difference value of opposite pixels between each of a plurality of sub block candidates of the second image and the second sub block every pixel ("Gharavi and Mills (1990) have proposed a simple matching criterion, namely, the PDC to reduce the computational complexity of the MSE and the MAE.", page 230, right column, third paragraph. The PDC (pixel difference classification) method is disclosed from them on until the next page 231. The second absolute difference value is computed for every block between both frames, and thus between sub block candidates of the second image and the second sub block every pixel as shown in equation (3).);

counting pixels in the first region that the second absolute difference value is less than a second threshold to obtain the number of pixels (Equation (4) is the equation responsible for counting pixels in the first region that the second absolute difference value is less than a second threshold to obtain the number of pixels. As cited by Chan, the first and second thresholds are both the value t.);

counting pixels in the second region on the second image that the first absolute difference value is less than the first threshold and the second absolute difference value is less than second threshold to obtain the second number of pixels (Equation (4) is the equation responsible for counting pixels in the second region that the first absolute difference value is less than a first

threshold to obtain the number of pixels. As cited by Chan, the first and second thresholds are both the value t.); and

selecting as the third sub block one of the second sub block candidates that sum of the number of pixels and the second number of pixels is maximum in a search range ("The candidate block that maximizes the PDC function is selected as the best matched block.", page 230, right column, fourth paragraph.).

Regarding **claim 10**, Chan discloses a method of generating an interpolation image ("In this paper, we present results for various block-matching techniques and propose a low-complexity block-matching motion-estimation algorithm that is useful for hybrid video coding schemes, including MPEG video.", page 228, left column, first paragraph) comprising:

dividing an interpolation image between a first image and a second image into a plurality of to-be-interpolated blocks (refer to references cited in claim 1);

searching for the first block of the first frame and the second block of the second frame, the first block and the second block being in alignment with the to-be-interpolated blocks and having a strong correlation to each other (refer to references cited in claim 1);

deriving a first motion vector between the first block and the second block (refer to references cited in claim 1);

extracting a first sub block and a second sub block from the first block, the first sub block including pixels that an absolute difference value between opposite pixels of the first block and the second block is less than a threshold, the second sub block including pixels that the absolute difference value is not less than the threshold (refer to references cited in claim 1);

extracting from each of the first image and the second image a region including pixels that the absolute difference value is not less than the threshold (refer to references cited in claim 1);

searching for a third sub block of the region of the first image and a fourth sub block of the region of the second image, the third sub block and the fourth sub block being in alignment with the to-be-interpolated blocks and having a strong correlation with respect to each other (Refer to references cited in claim 1. All blocks (including a third block of the current frame and a fourth block of the preceding frame) undergo the PDC block-matching algorithm as cited: "Gharavi and Mills (1990) have proposed a simple matching criterion, namely, the PDC to reduce the computational complexity of the MSE and the MAE.", page 230, right column, third paragraph.);

deriving a second motion vector between the third sub block and the fourth sub block ("The best matched block is used as a prediction estimate for the block. The relative displacement between the block and the best matched block constitutes the motion vector that is transmitted to the receiver. In bidirectional motion estimation, a previous reference frame as well as a future reference frame are used in determining the motion vector for each block. The motion vector corresponding to the previous or future reference frame that results in the smallest matching error is transmitted to the receiver.", page 229, left column, first paragraph.); and

copying the first sub block and the third sub block onto the interpolation image, using the first motion vector and the second motion vector ("A block diagram of the MPEG video coder is shown in Fig. 1. We note that this is essentially an interframe hybrid technique (Netravali 1988) which employs motion compensated prediction and interpolation followed by DCT coding. Here,

the video sequence is organized into a set of Group of Pictures (GOP). Often, each GOP is a combination of one Intraframe (I), one or two forward predicted (P) frames and the rest bidirectionally interpolated (B) frames as shown in Fig. 2. The B frames are used to achieve higher data compression and are motion-compensation interpolated at the receiver from previously received I and P frames. Hence, I and P frames serve as reference frames for motion-compensated predictions. Only the intraframe correlation is exploited in the I frames, whereas both the interframe and intraframe correlations are exploited in both the P and B frames.", page 229, right column, first paragraph").

Regarding **claim 11**, Chan discloses the method according to claim 10, wherein searching for the first block and the second block includes:

computing an absolute difference value between opposite pixels of the first block candidate of the first frame and the second block candidate of the second frame every pixel (The absolute difference value is computed for every block between both frames, and thus between sub block candidates of the first block candidate of the first frame and the second block candidate of the second frame every pixel as shown in equation (3).),

counting pixels that the absolute difference value is less than the threshold to obtain the number of pixels (Equation (4) is the equation responsible for counting pixels that the absolute difference value is less than the threshold. As cited by Chan, all thresholds are the value t.);

selecting as the first block the first block candidate that the pixel number is maximum in a search range, and selecting as the second block the second block candidate that the pixel number is maximum in a search range ("The candidate block that maximizes the PDC function is

selected as the best matched block.", page 230, right column, fourth paragraph. In essence, both the first block candidate and second block candidate have been "selected".).

Regarding **claim 12**, Chan discloses the method according to claim 10, wherein searching the third sub block and the fourth sub block includes:

computing a second absolute difference value between opposite pixels of the third sub block candidate of the first image and the fourth sub block candidate of the second image every pixel (The absolute difference value is computed for every block between both frames, and thus between sub block candidates of the third sub block candidate of the first image and the fourth block candidate of the second image every pixel as shown in equation (3).);

counting pixels that the second absolute difference value is less than the second threshold, with both of the pixels less than the threshold and the pixels not less than the threshold existing in the region, to obtain the number of pixels (Equation (4) is the equation responsible for counting pixels that the absolute difference value is less than the threshold. As cited by Chan, all thresholds are the value t.);

selecting as the third sub block the third block candidate that the number of pixels is maximum in a search range; and selecting as the fourth sub block the fourth block candidate that the number of pixels is maximum in a search range ("The candidate block that maximizes the PDC function is selected as the best matched block.", page 230, right column, fourth paragraph. In essence, both the third block candidate and fourth block candidate have been "selected".).

Regarding **claim 15**, Chan discloses an apparatus to generate an interpolation image ("In this paper, we present results for various block-matching techniques and propose a low-complexity block-matching motion-estimation algorithm that is useful for hybrid video coding schemes, including MPEG video.", page 228, left column, first paragraph.), comprising

an input unit configured to input a first image and a second image (Fig. 1 on page 229 is an MPEG-1 video coder of the disclosed invention. Fig. 1 shows an Frame Store from which inputted frames are stored.);

a division unit configured to divide the first image into a plurality of first blocks (Refer to references cited in claim 1. The device responsible for dividing the video frame into nonoverlapping 16 x 16 blocks is the division unit.);

searching a second image for a second block having a strong correlation with respect to one of the first blocks every first block (Refer to references cited in claim 1.);

a first motion vector detection unit configured to detect a first motion vector by searching the second image for a second block with a strong correlation with respect to one of the first blocks every first block (Refer to references cited in claim 1. The device responsible for producing the motion vector is the first motion vector detection unit.);

an extraction unit configured to extract from the first block a first sub block and a second sub block, the first sub block including pixels that an absolute difference value between opposite pixels of the first block and the second block is less than a threshold, and the second sub block including pixels that the absolute difference value is not less than the threshold (Refer to references cited in claim 1. The device responsible for carrying out this step is the extraction unit.);

a second motion vector detection unit configured to detect a second motion vector by searching a region on the second image that the absolute difference value is not less than the threshold for a third sub block with a strong correlation with respect to the second sub block (Refer to references cited in claim 1. The device responsible for producing the motion vector is the first motion vector detection unit.); and

an interpolation image generation unit configured to generate an interpolation image by copying the first sub block and the third sub block onto a third frame between the first image and the second image, using the first motion vector and the second motion vector (Refer to references cited in claim 1 and 19. The device responsible for producing this step is the interpolation image generation unit.).

Regarding **claim 16**, Chan discloses the apparatus according to claim 15, wherein the first motion vector detection unit comprises:

an absolute difference value computation unit configured to compute the absolute difference value between the opposite pixels of a second block candidate of the second image and the first block (Refer to references cited in claim 2. The device responsible for carrying out the PDC algorithm is the absolute difference value computation unit.);

a count unit configured to count pixels that the absolute difference value is less than the threshold to obtain the number of pixels (Refer to references cited in claim 2. The device responsible for carrying out the PDC algorithm is the count unit.); and

a selection unit configured to select as the second block the second block candidate that the number of pixels is maximum in a search range (Refer to references cited in claim 2. The device responsible for carrying out the PDC algorithm is the selection unit.).

Regarding **claim 17**, Chan discloses the apparatus according to claim 16, wherein the second motion vector detection unit comprises:

a second absolute difference value computation unit configured to compute a second absolute difference value between opposite pixels of a third sub block candidate of the second image and the second sub block (Refer to references cited in claim 3. The device responsible for carrying out the PDC algorithm is the second absolute difference value computation unit.);

a count unit configured to count pixels in the region that the second absolute difference value is less than the second threshold to obtains the number of pixels (Refer to references cited in claim 3 wherein all thresholds are equivalent to threshold t. The device responsible for carrying out the PDC algorithm is the count unit.); and

a second selection unit configured to select as the third sub block the third sub block candidate that the number of pixels is maximum in a search range (Refer to references cited in claim 3. The device responsible for carrying out the PDC algorithm is the second selection unit.).

Regarding **claim 18**, Chan discloses the apparatus according to claim 16, wherein the second motion vector detection unit comprises:

a second absolute difference value computation unit configured to compute a second absolute difference value between opposite pixels of a third sub block candidate of the second image and the second sub block (Refer to references cited in claim 3. The device responsible for carrying out the PDC algorithm is the second absolute difference value computation unit.);

a second count unit configured to count pixels in the region that the second absolute difference value is less than the second threshold to obtain the first number of pixels (Refer to references cited in claim 3 wherein all thresholds are equivalent to threshold t. The device responsible for carrying out the PDC algorithm is the count unit.);

a third count unit configured to count pixels in a second region on the second image that the absolute difference value is less than the first threshold, the pixels being pixels that the second absolute difference value is not less than the third threshold, to obtain the second number of pixels (Refer to references cited in claim 3 wherein all thresholds are equivalent to threshold t. The device responsible for carrying out the PDC algorithm is the count unit.); and

a second selection unit configured to select as the third sub block the third sub block candidate that sum of the first number of pixels and the second number of pixels is maximum in a search range Refer to references cited in claim 3. The device responsible for carrying out the PDC algorithm is the second selection unit.).

Regarding **claim 19**, Chan discloses an image display method ("In this paper, we present results for various block-matching techniques and propose a low-complexity block-matching motion-estimation algorithm that is useful for hybrid video coding schemes, including MPEG video.", page 228, left column, first paragraph.) comprising:

inputting an input image (Fig. 1 on page 229 is an MPEG-1 video coder of the disclosed invention. Fig. 1 shows an Frame Store from which inputted frames are stored.);

generating an interpolation image according to the method of claim 1 (refer to references cited in claim 1); and

displaying selectively the input image and the interpolation image (Fig. 2 on page 229 is an MPEG-1 Group of Pictures (GOP) for video display. "Often, each GOP is a combination of one Intraframe (I), one or two forward predicted (P) frames and the rest bidirectionally interpolated (B) frames as shown in Fig. 2. The B frames are used to achieve higher data compression and are motion-compensation interpolated at the receiver from previously received I and P frames. Hence, I and P frames serve as reference frames for motion-compensated predictions. Only the intraframe correlation is exploited in the I frames, whereas both the interframe and intraframe correlations are exploited in both the P and B frames. Generally, the I frames require two to three times as many bits as the P frames, which in turn require two to three times as many bits as the B frames.", page 228, right column, first paragraph. The block-matching techniques as disclosed by Chan are for video frames using the MPEG video standard. "In the first set of experiments, the performance of the MPDC-LSA is compared with that of the MSE-FSA, MAE-FSA, PDC-FSA, and PHODS for the hybrid video coder. A block size of 16 x 16 (n = 16) and a maximum displacement of 8 (p = 8) were used in this experiment. The simulation results are tabulated in Table 1 and plotted in Fig. 8 for the Miss America sequence at 1.18 Mbits/s (compression factor 20:1)…", page 236, left column, second paragraph as well as "Figure 12 contains frame number 6 of the original Miss America sequence.", page 238, right column, second paragraph).

Regarding **claim 20**, Chan discloses an image display system ("In this paper, we present results for various block-matching techniques and propose a low-complexity block-matching motion-estimation algorithm that is useful for hybrid video coding schemes, including MPEG video.", page 228, left column, first paragraph.) comprising:

an image input unit configured to input an input image (Fig. 1 on page 229 is an MPEG-1 video coder of the disclosed invention. Fig. 1 shows an Frame Store from which inputted frames are stored.);

the apparatus to generate an interpolation image, according to claim 15 (Refer to references cited in claim 15.); and

a display device to display selectively the input image and the interpolation image (Fig. 2 on page 229 is an MPEG-1 Group of Pictures (GOP) for video display. "Often, each GOP is a combination of one Intraframe (I), one or two forward predicted (P) frames and the rest bidirectionally interpolated (B) frames as shown in Fig. 2. The B frames are used to achieve higher data compression and are motion-compensation interpolated at the receiver from previously received I and P frames. Hence, I and P frames serve as reference frames for motion-compensated predictions. Only the intraframe correlation is exploited in the I frames, whereas both the interframe and intraframe correlations are exploited in both the P and B frames. Generally, the I frames require two to three times as many bits as the P frames, which in turn require two to three times as many bits as the B frames.", page 228, right column, first paragraph. The block-matching techniques as disclosed by Chan are for video frames using the MPEG video standard. "In the first set of experiments, the performance of the MPDC-LSA is

compared with that of the MSE-FSA, MAE-FSA, PDC-FSA, and PHODS for the hybrid video coder. A block size of 16 x 16 (n = 16) and a maximum displacement of 8 (p = 8) were used in this experiment. The simulation results are tabulated in Table 1 and plotted in Fig. 8 for the Miss America sequence at 1.18 Mbits/s (compression factor 20:1)…", page 236, left column, second paragraph as well as "Figure 12 contains frame number 6 of the original Miss America sequence.", page 238, right column, second paragraph.).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. **Claim 8** is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination between Chan et al. (<u>Experiments on block-matching techniques for video coding</u>, Multimedia Systems, Springer-Verlag 1994, 2:228-241) and Lynch (US 5,198,901 A).

Regarding **claim 8**, while Chan discloses the method according to claim 1, wherein copying includes copying the first sub block onto the third image, using the first motion vector (refer to references cited in claim 1), Chan does not teach that the copying includes obtaining a fourth sub block by subjected the second sub block and the third sub block to weighted average, and copying the fourth sub block onto the third image, using the second motion vector.

Lynch discloses a derivation and use of motion vectors in a differential pulse code modulation system ("In accordance with this invention, motion vectors for a block in a B frame are derived from the motion vector for a motion block in the following anchor frame whose projection along its motion vector to the previous anchor frame has the most overlap wwith that block.", column 2, line 64.) wherein the copying includes obtaining a fourth sub block by subjecting the second sub block and the third sub block to weighted average, and copying the fourth sub block onto the third image, using the second motion vector ("Additionally, a third motion block called an "interpolative predicted motion block" may be generated by performing a weighted average on the forward and backward predicted motion blocks.", column 9, line 5.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Chan to include a copying step that includes obtaining a fourth sub block by subjected the second sub block and the third sub block to weighted average, and copying the fourth sub block onto the third image, using the second motion vector as taught by Lynch "...to select the appropriate forward and backward predicted motion blocks from the past and future anchor frames...", Lynch, column 8, line 66. Accordingly, the copying step of Chan in view of Lunch includes copying the first sub block and the fourth sub block onto the third image, using the first motion vector and the second motion vector.

12. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination between Chan et al. (Experiments on block-matching techniques for video coding, Multimedia Systems, Springer-Verlag 1994, 2:228-241) and Wang et al. (US 6,625,333 A).

Regarding **claim 9**, while Chan discloses the method according to claim 1, Chan does not teach wherein the copying copies a fourth sub block and the third sub block onto the third image, the fourth sub block being on the second block and corresponding to the first sub block.

Wang discloses a method for temporal interpolation of an image sequence using object-based image analysis ("In accordance with the invention there is provided, a method for generating interpolated images of high quality for every type of image area.", column 2, line 39 and in more specific: "FIG. 12c is a block diagram illustrating schematically yet another embodiment of a method for temporal interpolation of an image according to the present invention.", column 4, line 31.) wherein copying copies a fourth sub block and the third sub block onto the third image, the fourth sub block being on the second block and corresponding to the first sub block ("Another preferred embodiment produces two interpolated images I'(.rho.,t) and I"(.rho.,t), as shown in FIG. 12c. Image I'(.rho.,t) is generated with segmentation of the first known image and motion estimation from the first known image towards the second known image, whereas I"(.rho.,t) is generated with segmentation of the second known image and motion estimation from the second known image towards the first known image.", column 10, line 28. By swapping both the predicted and current frame to undergo the same block-matching algorithm and eventual weighted averaging as taught by Wang, the Chan algorithm would include copying a fourth sub block and the third sub block onto the third image (because the fourth sub block would then become the first sub block when switched, and the third sub block would become the second sub block when switched).).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for the method of Chan to include a copying step that copies a fourth sub block and

the third sub block onto the third image, the fourth sub block being on the second block and corresponding to the first sub block as taught by Wang because "[t]his method usually provides interpolated images of even better quality...", Wang, column 10, line 51.

Allowable Subject Matter

13. **Claims 5, 6, 7, 13,** and **14** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claims 5, 6, 7, 13, and 14 while the prior art teaches various conceptual configurations of block matching (such as Fig. 1 through Fig. 3 of Chan) and techniques (such as MSE, MAE, and PDC), the prior art does not teach a difference in magnitude between thresholds as disclosed in claim 5, multiple absolute difference value comparisons to multiple thresholds between the frames as disclosed in claim 6, multiple absolute difference value comparisons to multiple thresholds between the frames by counting pixels of pixel pairs as disclosed in claim 13.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David P. Rashid whose telephone number is (571) 270-1578. The examiner can normally be reached on 7:30 - 17:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Werner can be reached on (571) 272-7401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DPR

David P Rashid
Examiner
Art Unit 2112

BRIAN WERNER
SUPERVISORY PATENT EXAMINER